MIL-S-19500/87A
31 May 1966
SUPERSEDING
MIL-S-19500/87(NAVY)
15 August 1960
(See 6.2)

MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE; TRANSISTOR, PNP GERMANIUM, LOW POWER TYPE 2N1142

This specification is mandatory for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the detail requirements for a low-power, high-frequency, PNP, germanium transistor.

1.2 Physical dimensions. See figure 1 (modified TO-39).

1.3 Ratings. See table I.

TABLE I. Maximum ratings

P_T 1/ T_A = 25° C	P_T 2/ T_C = 25° C	V_{CBO}	V_{EBO}	I_C	T_{stg}	T_J
mW	mW	Vdc	Vdc	mAdc	°C	°C
300	750	-30	-0.7	100	-65 to +100	+100

1/ Derate linearly at 4.0 mW/°C for $T_A >$ 25° C

2/ Derate linearly at 10.0 mW/°C for $T_C >$ 25° C

1.4 Characteristics. See table II.

TABLE II. Primary electrical characteristics

Limits	h_{FE} V_{CE} = -10 Vdc I_C = -10 mAdc	h_{fe} V_{CE} = -10 Vdc I_C = -10 mAdc f = 100 mc	C_{obo} V_{CB} = -10 Vdc I_E = 0 f = 1 mc	V_{CE} (sat) I_C = -50 mAdc I_B = -10 mAdc
		db	pf	Vdc
Min	10	10	---	---
Max	---	---	4	-2

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein.

SPECIFICATION

MILITARY

MIL-S-19500 - Semiconductor Devices, General Specification for.

FSC 5961

STANDARDS

MILITARY

MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.
MIL-STD-750 - Test Methods for Semiconductor Devices.

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 General. Requirements shall be in accordance with MIL-S-19500, and as specified herein.

3.2 Abbreviations, symbols, and definitions. The abbreviations, symbols, and definitions used herein are defined in MIL-S-19500.

3.3 Design, construction, and physical dimensions. - Transistor shall be of the design, construction, and physical dimensions shown on figure 1.

3.4 Performance characteristics. Performance characteristics shall be as specified in tables III, IV, and V.

3.5 Marking. The following markings specified in MIL-S-19500 may be omitted from the body of the transistor at the option of the manufacturer:

(a) Country of origin.

(b) Manufacturer's identification.

4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection shall be in accordance with MIL-S-19500, and as specified herein.

4.2 Qualification inspection. Qualification inspection shall consist of the examinations and tests specified in tables III, IV, and V.

4.3 Quality-conformance inspection. - Quality conformance inspection shall consist of group A, B, and C inspections.

4.3.1 Group A inspection. Group A inspection shall consist of the examinations and tests specified in table III.

4.3.2 Group B inspection. Group B inspection shall consist of the examinations and tests specified in table IV.

4.3.3 Group C inspection. Group C inspection shall consist of the examinations and tests specified in table V. This inspection shall be conducted on the initial lot and every 6 months thereafter during production.

4.4 Methods of examination and tests. Methods of examination and test shall be as specified in tables III, IV, V, and as follows:

4.4.1 Noise figure. The noise figure shall be measured using the following commercially available test equipment and its associated standard test procedures, or suitable equivalent test equipment and procedures.

(a) Hewlett-Packard VHF Noise Source, Type 343A.

(b) Hewlett-Packard Noise Figure Meter, Type 342A.

A block diagram of the test equipment setup is shown on figure 3.

4.4.1.1 The test fixture shall consist of a 105-Mc tuned amplifier and suitable biasing circuits. It should be constructed utilizing good very-high-frequency design techniques.

4.4.1.2 The effective source susceptance should be tuned for each device being tested to obtain minimum noise figure. Note that because the HP 343A has a 50-ohm output resistance, a suitable impedance transformer must be used to obtain an effective source conductance of 13.3 mmho at the transistor with minimum losses.

5. PREPARATION FOR DELIVERY

5.1 See MIL-S-19500, section 5.

6. NOTES

6.1 Notes. The notes specified in MIL-S-19500 are applicable to this specification.

6.2 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Custodians:
Army - EL
Navy - SH
Air Force - 11

Preparing activity:
Navy - SH

(Project 5961-0013-19)

Review activities:
Army - EL, MU, MI
Navy - SH
Air Force - 11, 17, 85

User activities:
Army - EL, SM
Navy - CG, MC, AS, OS
Air Force - 14, 19

TABLE III. Group A inspection

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		
	Method	Details			Min	Max	Unit
Subgroup 1			10				
Visual and mechanical examination	2071			---	---	---	---
Subgroup 2			5				
Breakdown voltage, collector-to-base	3001	Bias cond. D I_C = -0.1 mAdc		BV_{CBO}	-30	---	Vdc
Breakdown voltage, emitter-to-base	3026	Bias cond. D I_E = -0.1 mAdc		BV_{EBO}	-0.7	---	Vdc
Collector-to-emitter cutoff current	3041	Bias cond. A V_{CE} = -15 Vdc V_{BE} = +0.2 Vdc		I_{CEX}	---	-5	uAdc
Collector-to-base cutoff current	3036	Bias cond. D V_{CB} = -15 Vdc		I_{CBO}	---	-5	uAdc
Collector-to-emitter voltage (saturated)	3071	I_C = -50 mAdc I_B = -10 mAdc		$V_{CE}(sat)$	---	-2	Vdc
Forward-current transfer ratio	3076	V_{CE} = -10 Vdc I_C = -10 mAdc		h_{FE}	10	---	---
Subgroup 3			10				
Small-signal short-circuit forward-current transfer ratio	3306	V_{CE} = -10 Vdc I_C = -10 mAdc f = 100 mc		h_{fe}	10	---	db
Open-circuit output capacitance	3236	V_{CB} = -10 Vdc I_E = 0 f = 1 mc		C_{obo}	---	4	pf
Noise figure	---	V_{CB} = -10 Vdc I_E = 1 mAdc f = 105 mc Noise source conductance = 13.3 mmho (See 4.4.1.)		NF	---	10	db
Small-signal short-circuit input impedance	3201	V_{CB} = -10 Vdc I_C = -10 mAdc		h_{ib}	---	7.5	ohms
Small-signal short-circuit output admittance	3231	V_{CB} = -10 Vdc I_C = -10 mAdc		h_{ob}	---	100	umhos
High-temperature operation:	---	T_A = +55° C		---	---	---	---
Collector-to-base cutoff current	3036	Bias cond. D V_{CB} = -15 Vdc		I_{CBO}	---	-80	uAdc

TABLE IV. Group B inspection

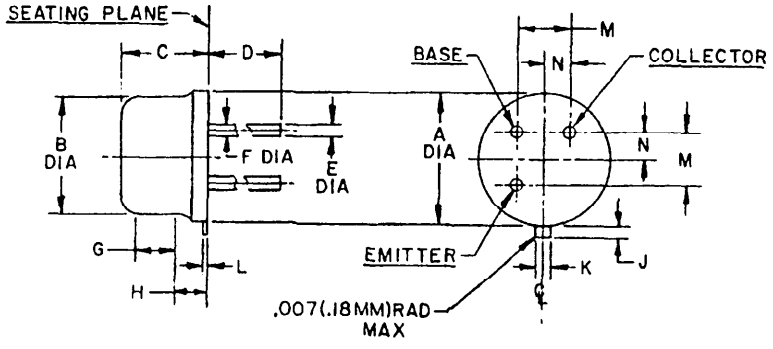
Examination or test	MIL-STD-750		LTPD	Symbol	Limits		
	Method	Details			Min	Max	Unit
Subgroup 1			20				
Physical dimensions	2066	See figure 1		---	---	---	---
Subgroup 2			15				
Solderability	2026	Omit aging		---	---	---	---
Thermal shock (temperature cycling)	1051	Test cond. B, except step 3, $t_{max} = 95 \, ^{+5}_{-0}$ °C		---	---	---	---
Thermal shock (glass strain)	1056	Test cond. A		---	---	---	---
Seal (leak-rate)	----	Method 112 of MIL-STD-202, test cond. C, procedure III; test cond. B for gross leaks		---	---	$5x10^{-7}$	atm cc/sec
Moisture resistance	1021			---	---	---	---
End points:							
Collector-to-base cutoff current	3036	Bias cond. D V_{CB} = -15 Vdc		I_{CBO}	---	-10	uAdc
Forward-current transfer ratio	3076	V_{CE} = -10 Vdc I_C = -10 mAdc		h_{FE}	8	---	---
Subgroup 3			15				
Shock	2016	Nonoperating; 500 G approx. 1 msec, 5 blows in each orientation: X_1, Y_1, Y_2, and Z_1.		---	---	---	---
Vibration fatigue	2046	Nonoperating		---	---	---	---
Vibration, variable frequency	2056	Nonoperating		---	---	---	---
Constant acceleration	2006	10,000 G; in each orientation: X_1, Y_1, Y_2, and Z_1.		---	---	---	---
End points:							
(Same as for subgroup 2.)							
Subgroup 4			15				
Terminal strength (lead fatigue)	2036	Test cond. E		---	---	---	---

TABLE IV. Group B inspection (cont)

Examination or test	MIL-STD-750		LTPD	Symbol	Limits		
	Method	Details			Min	Max	Unit
Subgroup 5			15				
Salt atmosphere (corrosion)	1041			---	---	---	---
End points:							
(Same as for subgroup 2.)							
Subgroup 6			λ = 10				
High-temperature life (nonoperating)	1031	T_{stg} = +100 °C		---	---	---	---
End points:							
(Same as for subgroup 2.)							
Subgroup 7			λ = 10				
Steady-state-operation life	1026	P_T = 300 mW V_{CB} = -10 Vdc		---	---	---	---
End points:							
(Same as for subgroup 2.)							

TABLE V. Group C inspection

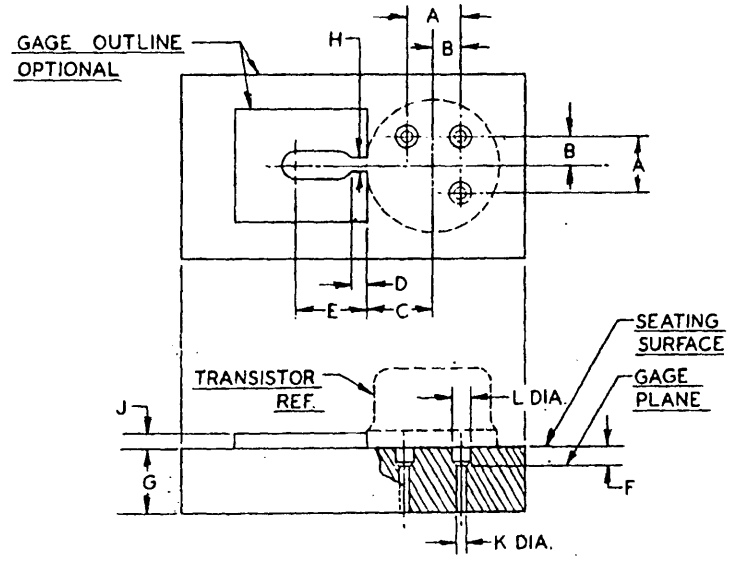
Examination or test	MIL-STD-750		LTPD	Symbol	Limits		
	Method	Details			Min	Max	Unit
Subgroup 1			15				
Barometric pressure, reduced (altitude operation)	1001	Normal mounting; Pressure = 8mm Hg for 60 sec min		---	---	---	---
Measurement during above test:							
Collector-to-base cutoff current	3036	Bias cond. D V_{CB} = -30 Vdc		I_{CBO}	---	-100	uAdc
Thermal resistance	3151			θ_{J-C}	---	0.1	°C/mW



NOTES:
1. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.
2. Measured in the zone beyond .250 (6.35 mm) from the seating plane.
3. Measured in the zone .050 (1.27 mm) and .250 (6.35 mm) from the seating plane.
4. Variations on dim B in this zone shall not exceed .010 (.25 mm).
5. Outline in this zone is not controlled.
6. When measured in a gaging plane .054 +.001 (1.37 +.03 mm) below the seating plane of the transistor max dia leads shall be within .007 (.18 mm) of their true location. Smaller dia leads shall fall within the outline of the max dia lead tolerance. Figure 2 shows preferred measurement method.
7. The collector is electrically connected to the case.
8. Measured from the maximum diameter of the actual device.
9. All three leads.

Ltr	Dimensions in inches with metric equivalents (mm) in parentheses (see note 1)		Notes
	Minimum	Maximum	
A	.335 (8.51)	.370 (9.40)	--
B	.305 (7.75)	.335 (8.51)	--
C	.240 (6.10)	.260 (6.60)	--
D	.300 (7.62)	---	9
E	.016 (.41)	.021 (.53)	2,9
F	.016 (.41)	.019 (.48)	3,9
G	.100 (2.54)	---	4
H	---	---	5
J	.029 (.74)	.045 (1.14)	8
K	.028 (.71)	.034 (.86)	--
L	.009 (.23)	.125 (3.18)	--
M	.1414 (3.59) Nom		6
N	.0707 (1.80) Nom		6

FIGURE 1. Physical dimensions of transistor type 2N1142 (modified TO-39).



NOTES:
1. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.
2. The following gaging procedure shall be used: The use of a pin straightener prior to insertion in the gage is permissible. The device being measured shall be inserted until its seating plane is .125 ±.010 (3.18 ± .25 mm) from the seating surface of the gage. A spacer may be used to obtain the .125 (3.18 mm) distance from the gage seat prior to force application. A force of 8 oz±.5 oz shall then be applied parallel and symmetrical to the device's cylindrical axis. When examined visually after the force application (the force need not be removed) the seating plane of the device shall be seated against the gage.
3. The location of the tab locator, within the limits of dimension C, will be determined by the tab and flange dimension of the device being checked.

Ltr	Dimensions in inches with metric equivalents (mm) in parentheses (see note 1)	
	Minimum	Maximum
A	.1409 (3.58)	.1419 (3.60)
B	.0702 (1.78)	.0712 (1.81)
C	.182 (4.62)	.199 (5.05)
D	.009 (.23)	.011 (.28)
E	.125 (3.18) Nom	
F	.054 (1.37)	.055 (1.40)
G	.372 (9.45)	.378 (9.60)
H	.0350 (.89)	.0355 (.90)
J	.150 (3.81) Nom	
K	.0325 (.83)	.0335 (.85)
L	.0595 (1.51)	.0605 (1.54)

FIGURE 2. Gage for lead and tab location for transistor type 2N1142.

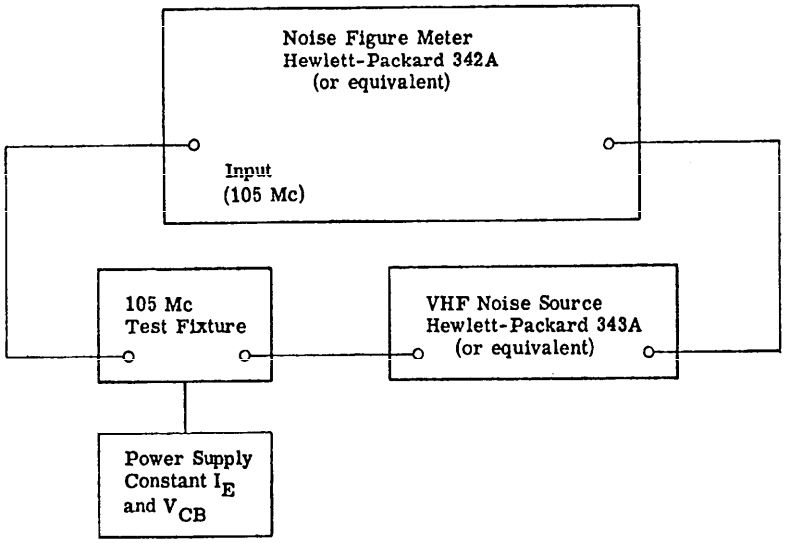


FIGURE 3. Block diagram for noise figure test.